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NOTE ON THE ASCOSPORIC CONDITION OF THE GENUS ASCHERSONIA MONTAGNE¹

ROLAND THAXTER

(WITH SEVEN FIGURES)

The genus *Aschersonia* includes a group of entomogenous fungi which have hitherto found a place among the Sphaeropsideae, since, as far as I am aware, no ascosporic condition has as yet been observed in connection with any of them. Although a great majority of the forty or more species which have been described, for the most part from the tropics, are said to occur on the leaves, etc., of various hosts among the vascular plants, there can be no question in the mind of anyone who has had an opportunity to examine them in a fresh condition that they are strictly entomogenous, like the species of the genus *Hypocrella*, which have a similar habitat on various types of scale insects; and, as is well known, two species of the genus have been successfully employed in Florida against certain scales attacking *Citrus*. As in the case of other entomogenous fungi, the character of the host plant on which species of *Aschersonia* have been reported is thus a matter of very little importance, except in so far as it may suggest the nature of the scale which has been attacked while feeding on it. Although it is not improbable that some of the species are not restricted to closely similar hosts, there are indications that others are more definitely conditioned in this respect, and an examination of this matter from the entomological side is much to be desired. Unfortunately, very little information is available in this connection, and the actual hosts of the too numerous and ill defined species, a majority of which have been described within the past fifteen years, are, with a very few exceptions, quite unknown.

In view of the general characteristics of *Aschersonia*, it has been naturally assumed that the ascosporic form, if it exists, would find a place among the Hypocreaceae, the often bright though very variable and inconstant colors and comparatively soft con-

¹ Contributions from the Cryptogamic Laboratories of Harvard University, LXII.
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sistency of the different species pointing to this conclusion. It has been suggested that they might be imperfect conditions of species of the ascomycetous genus *Hypocrella*, with which, owing to their similar mode of life, they are apt to be associated; and this suggestion is still further supported by the fact that when a flat hemispherical type of *Aschersonia* has become blackened by age and exposure, or colored by the sooty disintegrated material of accompanying *Capnodia*, which grow on the excreta of various hemipterous insects, it is often difficult to distinguish the two by their gross appearance. Definite information in regard to this connection, however, has hitherto been lacking, and, as already mentioned, I have found no record of observations which might throw light upon it. P. HENNINGS in the *ASCHERSON Festschrift*, where he discusses the validity of the generic name and certain other matters, states that he was informed by ZIMMERMAN, whose contributions to the knowledge of Javan entomogenous fungi are well known, that although he sought for them with care he never encountered any individuals which showed indications of an ascosporic fructification.

During the past year (1912-1913) I had an opportunity to spend some months on the islands of Grenada and Trinidad, and having the matter in mind made a special effort to discover this problematical ascosporic form. In the locality where I remained during practically my whole stay in Grenada, *Aschersoniae* were by no means numerous, and only three species were met with. These forms, moreover, were comparatively rare, although one of them, the well known and characteristic though very variable *A. turbinata*, was found several times. A few specimens of this species in the original gathering from a certain locality showed, when carefully examined, certain not very conspicuous but suspicious looking pustules, containing cavities unlike those of the pycnidia, which appeared to be young perithecia, and by a systematic search in the same spot I was able to obtain numerous specimens bearing the perfect form fully and characteristically developed. Unluckily, the majority of these specimens were accidentally destroyed by fire, together with many other mycologic treasures, but a sufficient number were saved, both dry and in alcohol.

In Trinidad, where the flora as well as the insect fauna is far more varied, *Aschersoniae* were numerous, and in most instances it was possible to gather abundant material of each species. These gatherings in the case of four or five species usually included the ascosporic condition, which was often abundant, and, as in the case of *A. turbinata*, occurred either by itself or associated on the same stroma with the pycnidial form; so that there could be no question as to the actual connection of the two conditions. As far as could be determined, the position of growth, whether on the upper or lower side of a leaf for example, in shady and moist or in drier and more open situations, has little if any influence on the development of the perfect condition. In some instances it appeared to follow the pycnidia in older specimens, while in others it was as evidently primary in its development and unaccompanied by pycnidia.

The general character and appearance of the perfect condition recall those of some species of the genus *Cordyceps*, to which *Aschersonia* is evidently closely related; and, as in this instance, the association of the perithecia and the development of perithecial stromata varies in different cases. In some instances the perithecia may be closely and definitely grouped in a compact and prominent stromatic outgrowth from the general stroma, which may be otherwise sterile, while in many the whole stromatic mass may become transformed into a pulvinate aggregation of densely crowded perithecia. The general appearance of such forms, which in one instance may be definitely stalked, is not unlike that of some species of *Cordyceps* or *Hypomyces*. In other cases the perithecia may be irregularly scattered in a somewhat looser stroma, and might at first be mistaken for the common *Cordyceps* (*Torrubiella*) *arachnophila*, which is often found on leaves with or without its imperfect or *Isaria* (*Gibellula*) condition. But in this instance, although the host may be as completely obliterated as it is by *Aschersoniae*, the perithecia are always much more prominent.

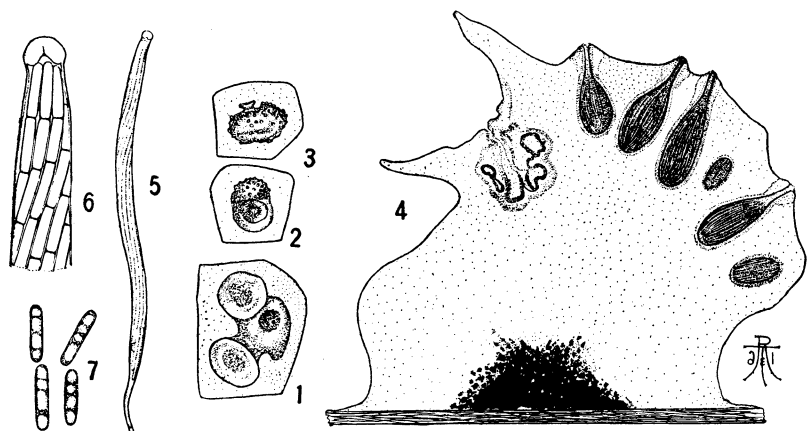
Having assembled a considerable number of *Aschersoniae* from various sources, it was first my intention to attempt a revision of the genus, but an examination of the literature and such material as is available has made it evident that this is hardly possible at

the moment, the great variability of the individual species as regards habit, size, and color, the usually insignificant differences in their spores as well as the absence of any information as to the nature of their true hosts, except in a very few cases, combining to make their systematic study a matter of great difficulty. It has seemed desirable, therefore, in the present connection to attempt no more than a brief preliminary note on the ascosporic stage of *A. turbinata*, a species which, although it is extremely variable in habit, size, and color, is in its typical form quite unmistakable.

Although the perithecial stromata of *Aschersonia turbinata* are less highly specialized than they are in some of the species, the perithecia are usually aggregated in more or less distinct pustules which, more frequently in this than in others, seem to arise after the pycnidial form has practically ceased its activities. Often, however, the whole stroma is perithecigerous, and no pycnidia precede or accompany them. In some cases these perithecial groups are very small, as in fig. 1, where less than a dozen have been produced from an old stroma bearing two well developed pycnidial cups. In fig. 2 a smaller but similar cup is associated with a much more definitely developed perithecial pustule, and fig. 4 shows in section a similar condition. In fig. 3 almost all of the original stroma is perithecigerous, a small pycnidial cup being present at the side, while the perithecia are more scattered. The section of such a specimen (fig. 4) shows a continuous homogeneous stroma, composed in all parts of absolutely identical, closely and intricately interwoven, thick-walled, undifferentiated hyphae; so that, were it not otherwise evident, there can be no question that the perithecia observed are those of the *Aschersonia*, and not of some other fungus parasitic on its stroma. It may here be mentioned, however, that several such parasites have been observed, although their characteristics are quite different.

The perithecial cavities, as shown in fig. 4 at right, are almost completely imbedded in this stroma. They are bottle-shaped, with a relatively narrow and well defined neck, about $440 \times 150 \mu$, and are surrounded by a more dense, thin perithecial wall, the substance of which is like the similar but broader layer which sur-

rounds the neck and forms the bulk of a definite though not very prominent papilla which marks the position of the perithecium externally, and is perforated by the ostiole. The asci (fig. 5), which arise from a slight cushion at the base of the perithecial cavity, are about $210 \times 7-8 \mu$, rather slender at maturity, tapering slightly to the peculiarly differentiated apex, which is modified (fig. 6) in a fashion exactly resembling that seen in the asci of *Cordyceps* and its allies. As the asci mature, the stalk becomes more elongate and slender than is represented in fig. 5, and the



FIGS. 1-7.—*Aschersonia turbinata* Berk.: figs. 1-3, three stromata bearing pycnidial cups and perithecial pustules, $\times 3.5$; fig. 4, section of a stroma similar to that shown in fig. 2; a pycnidial cup at the left, the perithecial pustule at the right (the remains of the coccus host in the middle next the substratum (Zeiss A+2); fig. 5, ascus not fully mature (Zeiss D+4); fig. 6, tip of a nearly mature ascus showing segmented spores, and fig. 7, separated spore-segments; both Leitz water im. $\times 12$; figs. 4-7 are reduced to one-half.

eight filamentous spores, which are at first cylindrical and continuous, are later divided by septa as in *Cordyceps*. The segments thus formed eventually separating from one another, the ascus becomes filled with countless spores, rodlike in form, about $10-12 \times 2-2.5 \mu$, with rounded ends (fig. 7). The spores and their segments are conspicuously vacuolate, so that they present a banded appearance which gives them a distinct individuality.

The characters briefly enumerated above apply in general to the perfect conditions of the remaining species in which they have

been observed, the specific variations, in so far as I have examined them, consisting in minor differences relating to the distribution, form, and size of the perithecia, the size of the spore-segments, etc., but since, for the reasons above stated, it seems almost impossible at the moment to determine them accurately, any further account of them must be deferred.

HARVARD UNIVERSITY